

NASA TECH BRIEF



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Computer Program for High Pressure Real Gas Effects

This program has potential widespread use in industries concerned with real gas effects.

The problem:

A need existed to calculate the mass-flow rate of helium and nitrogen at pressures greater than 100×10^5 newtons per square meter.

The solution:

A computer program which will obtain the real-gas isentropic flow functions and thermodynamic properties of gases for which the equation of state is known.

How it's done:

The program uses FORTRAN IV subroutines which were designed for calculations of nitrogen and helium. These subroutines can be easily modified for calculations of other gases.

The program was used to calculate a critical flow factor that permits the isentropic mass-flow rate of nitrogen and helium through critical flow nozzles to be calculated from plenum conditions. In addition, the results include the nozzle throat velocity, the compressibility factor, the entropy, the enthalpy, the specific heat at constant pressure, the specific-heat ratio, and the ratios of throat to plenum pressure, density and temperature. These results are tabulated

as functions of the plenum pressure and temperature. The calculations cover a temperature range from near condensation to 400°K and a pressure range from 0 to 300×10^5 newtons per square meter (approximately 300 atm).

The program permits three different sets of independent variables. In addition to the plenum pressure and temperature, the other independent variable is either the nozzle exit pressure, the nozzle exit Mach number, or the nozzle exit temperature.

Notes:

1. This program is written in FORTRAN IV for use on the IBM 7094.
2. Inquiries should be made to:

COSMIC
Computer Center
University of Georgia
Athens, Georgia 30601
Reference: B69-10222

Patent status:

No patent action is contemplated by NASA.

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